Sociodemographic correlates of overall quality of dietary intake of US adolescents

By: Debra K. Goodwin , Linda K. Knolb, James M. Eddy, Eugene C. Fitzhugh, Olivia Kendrick, Roberta E. Donohue

Goodwin, D., Knol, L., Eddy, J.M., Fitzhugh, E., and Donahue, R. (2006) Sociodemographic correlates of overall dietary intake of US adolescents. *Nutrition Research*, 26, 105-110.

Abstract:
The purpose of this study was to examine the relationships between selected sociodemographic variables and overall quality of dietary intake of US adolescents. The Healthy Eating Index, an instrument designed to measure adherence to the US Dietary Guidelines, was used to measure overall quality of dietary intake. Healthy Eating Index scores were computed for a sample of US adolescents (N = 1504) who participated in the 1994-1996 Continuing Survey of Food Intakes by Individuals. A proportional odds model for an ordered polytomous response was used to assess the relationships between adolescent Healthy Eating Index scores and selected socio-demographic factors. The sociodemographic factors found to be significantly related to overall quality of dietary intake of US adolescents were age, ethnicity, urbanization, region of residence, and education level of household head. The findings of this study suggest that nutrition research and intervention programs relating to US adolescents should include evaluation of sociodemographic/environmental factors.
Keywords: Adolescent; Diet; HEI; Overall dietary quality; CSFII

Article:

1. Introduction

National health statistics reveal that 4 of the 10 leading causes of death in the United States (coronary heart disease, stroke, cancer, and diabetes) are associated with dietary factors [1]. It is estimated that these health problems account for more than $200 billion annually in medical costs and lost productivity [2]. Furthermore, studies suggest that dietary behaviors developed in adolescence are influenced by personal, family, and social factors and continue into adulthood, thereby increasing the risk for chronic disease later in life [3-6]. Although there is abundant contemporary research [7-12] regarding the relationships between sociodemographic factors and various aspects of adolescent diets, few studies [13-15] have explored the relationships between sociodemographic factors and the overall quality of dietary intake of US adolescents. The current study is one of the few attempts to evaluate these relationships. Future studies of this nature could help to properly focus nutrition education interventions in the adolescent population.

One way to assess overall dietary intake is through the use of the Healthy Eating Index, or HEI [16]. The HEI, based on the USDA Food Guide Pyramid [17] and the Dietary Guidelines for Americans [18], evaluates the overall quality of dietary intake of individuals in terms of adequacy, moderation, and variety. This index is a concise method of comparing the entire dietary pattern, as opposed to single nutrients, to the Dietary Guidelines for Americans [18] and has been used to examine the associations between a range of health indicators and overall dietary intake [13-15]. The primary purpose of this study was to identify sociodemographic factors that may be significantly related to the overall quality of dietary intake in a national sample of adolescents to help clarify possible links between environmental factors and dietary quality.

2. Methods and materials

2. 1. Subjects

This secondary data analysis used the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) [19], also known as "What We Eat in America Survey," which provided a representative sample of US adolescents. The CSFII is a multistaged, clustered, probability sample, designed to provide US population estimates of dietary intake with oversampling of low-income individuals. Dietary data included 2 nonconsecutive days of self-reported food intake from noninstitutionalized subjects living in the United States. The sample of adolescents (N = 1504) selected ranged in age from 11 years to 18 years. This age grouping is consistent with the age groupings described in the Dietary Reference Intakes [20], with one exception, children ages 9 and 10 years were omitted to capture only adolescents.

2.2. Measures

The HEI was used to measure overall dietary quality among adolescents. The HEI consists of 10, equally weighted, dietary components [17]. The first 5 components measure compliance with the recommended servings from each food group of the Food Guide Pyramid based on individual energy intake (Table 1). The next 4 components measure dietary moderation by assessing conformity to the Dietary Guidelines for Americans [18] regarding recommendations for consumption of total fat, saturated fat, cholesterol, and sodium. The last component measures dietary variety by counting the number of different food items consumed that represent at least one half of a serving from one of the Food Guide Pyramid food groups. Each component is scored on a scale of 0 to 10, where a score of 10 represents conformity with the guideline, a score of 0 represents nonconformity with the guideline, and scores in between represent some conformity to the guideline. The overall HEI score is the sum of all 10 component scores.

Table 1
Components of the HEI and scoring system

	Score ranges[a]	Criteria for maximum score of 10	Criteria for minimum score of 0
Grain consumption	0-10	6-11 servings[b]	0 servings
Vegetable consumption	0-10	3-5 servings[b]	0 servings
Fruit consumption	0-10	2-4 servings[b]	0 servings
Milk consumption	0-10	2-3 servings[b]	0 servings
Meat consumption	0-10	2-3 servings[b]	0 servings
Total fat intake	0-10	≤30% energy from fat	≥45% energy from fat
Saturated fat intake	0-10	<10% energy from saturated fat	≥15% energy from saturated fat
Cholesterol	0-10	≤300 mg	≥450 mg
Sodium intake	0-10	≤2400 mg	≥4800 mg
Food variety	0-10	≥8 different items in a day	≤3 different items in a day

Adapted from reference [15].
a People with consumption or intakes between the maximum ranges or amounts were assigned scores proportionately.
b Number of servings for the maximum score depends on individual energy intake. All amounts are on a per-day basis.

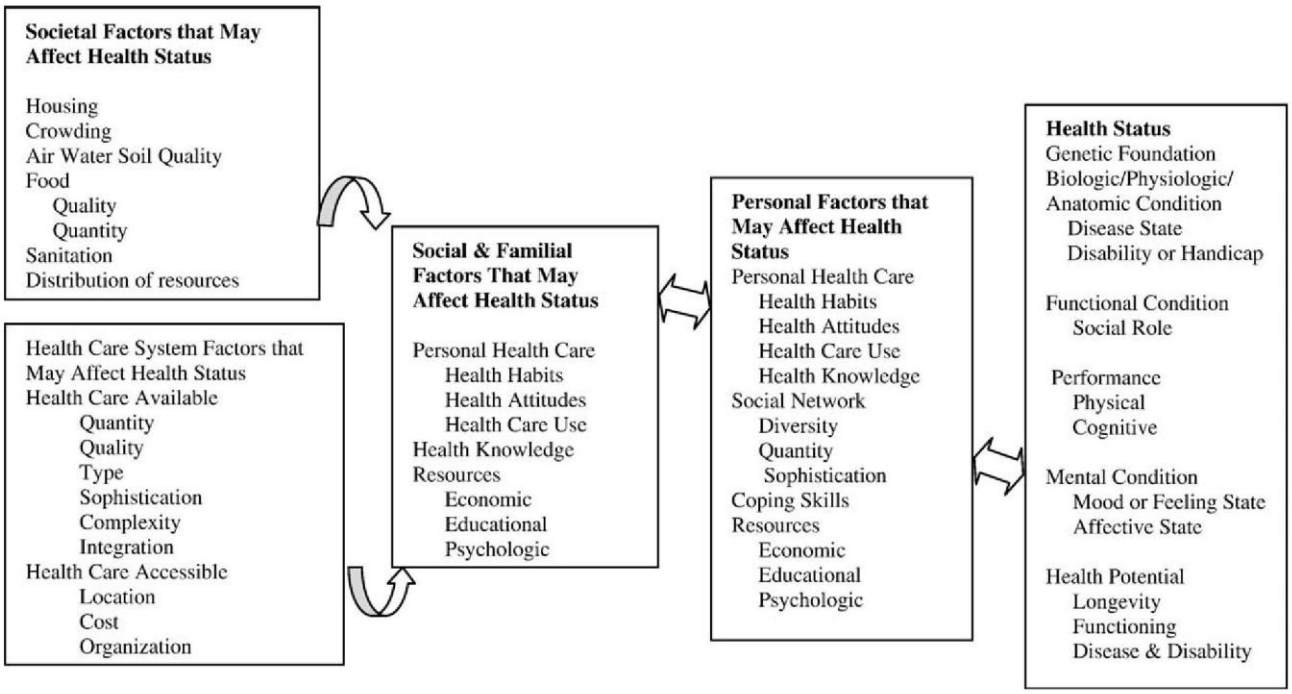

Fig. 1. Dimensions of health status. Adapted from *Med Care* 1985;23(5):696-704.

For this research study, the overall HEI score was calculated based on 2 days of dietary recall data. All component scores were first calculated for each day and then totaled for the overall HEI score. Then, the HEI overall scores for each day were averaged. The 2-day average HEI scores were rank-ordered, expressed as tertiles, and classified as LOW (lower third), MID (middle third), and HIGH (upper third). Therefore, adolescents whose average HEI scores placed them within the HIGH group would have diets that comply most closely with current US dietary guidance or the Dietary Guidelines for Americans [18].

The selection of sociodemographic factors used in this analysis was guided by Bergner's [21] model of health status (Fig. 1). Bergner's model is theoretically ecological and demonstrates the different levels of environmental influences that are interrelated to health status. The first level of influence is composed of personal factors. The second level of influence represents social and familial influences. The third and last level of influence includes societal and health care system factors. For this study, the selected sociodemographic factors were classified into two levels of influence: individual factors (corresponding to Bergner's personal factors) including age, sex, and ethnicity; and family factors (corresponding to a combination of Bergner's social/familial factors and societal factors) including region of residence, urbanization, number of household members, education level of head of household, female head of household, and household income level.

2.3. Statistical methods

SAS 8.2 (SAS Institute Inc, Cary, NC) was used to recode variables, whereas SUDAAN 8.0.1 [22] was used for all inferential testing. SUDAAN software enlists a number of procedures used to analyze data from complex sample surveys involving both sampling weights and cluster correlated data. To account for the design effects associated with the CSFII [19], the survey authors recommend that inferential statistics be computed using a statistical software program designed for the analysis of sample survey data, such as SUDAAN. Multiple regression analysis was used to assess the relationships between HEI, expressed as tertiles, and the selected sociodemographic factors. The response variable, in this case HEI tertile, is a nominal variable. Thus, relationships between HEI and selected sociodemographic factors

were tested using a cumulative logit model. Using the MULTILOG procedure in SUDAAN, the likelihood of being in the high, mid, or low tertile was compared across each selected sociodemographic factor after controlling for all other factors. The MULTILOG procedure estimates the odds and adjusted odds for HIGH and MID tertile HEI scores in the same model where the LOW HEI tertile is the reference.

3. Results

This study included 1504 adolescents in the United States, ranging in age from 11 to 18 years, who participated in the CSFII. Sample characteristics have been published elsewhere [19]. Healthy Eating Index scores were computed to measure overall dietary quality and rank-ordered by tertile. The mean HEI score, representing overall dietary quality of the US adolescent population, was 61.9 (SE = 0.4) out of a possible score of 100. The average HEI scores by tertile were 51.0 (SE = 0.3), 61.8 (SE = 0.1), and 72.1 (SE = 0.3) for the low, mid, and high tertile, respectively. Those adolescents ranking in the low tertile had the lowest dietary quality, as indicated by HEI scores, and those ranking in the high tertile had the highest dietary quality.

Table 2
Distribution of individual and family factors in tertiles of overall HEI[a] scores of US adolescents: CSFII

Sociodemographic characteristics	HEI low tertile	HEI mid tertile	HEI high tertile
Individual factors[b]			
Age (mean ± SE)	14.90 ± 0.11	14.31 ± 0.10	14.06 ± 0.09
Sex (% ± SE)			
Female	33.46 ± 2.04	32.02 ± 1.94	34.52 ± 2.24
Male	31.77 ± 2.68	32.48 ± 2.07	35.75 ± 2.66
Ethnicity (% ± SE)			
Hispanic	32.12 ± 3.34	32.56 ± 3.40	35.32 ± 4.98
Non-Hispanic white	29.53 ± 1.96	32.26 ± 1.82	38.21 ± 2.35
Non-Hispanic black	50.27 ± 3.36	31.34 ± 2.91	18.40 ± 3.09
Other	16.46 ± 4.64	34.25 ± 6.71	49.29 ± 8.32
Family factors (living arrangements)[b]			
Region (% ± SE)			
Northeast	24.89 ± 5.46	29.58 ± 3.18	45.53 ± 5.70
Midwest	27.95 ± 2.80	34.64 ± 3.08	37.41 ± 4.36
South	41.61 ± 2.64	32.17 ± 1.68	26.22 ± 3.53
West	30.17 ± 2.20	31.88 ± 2.65	37.95 ± 3.16
Urbanization			
MSA (central city)	31.50 ± 2.60	32.81 ± 3.00	35.69 ± 3.95
MSA (urban)	28.32 ± 2.24	31.52 ± 1.67	40.16 ± 2.40
Non-MSA (rural)	43.07 ± 2.67	33.04 ± 1.27	23.89 ± 3.05
Household members (mean ± SE)	4.43 ± 0.11	4.36 ± 0.08	4.52 ± 0.11
Household head education (% ± SE)			
Less than high school	43.14 ± 4.03	27.28 ± 2.77	29.58 ± 3.70
High school	37.81 ± 2.37	33.79 ± 2.16	28.40 ± 2.98
More than high school	25.09 ± 2.49	32.52 ± 2.26	42.39 ± 3.03
Female head of household (% ± SE)			
Yes	39.81 ± 3.55	32.28 ± 2.79	27.92 ± 3.36
No	30.41 ± 1.80	32.47 ± 1.57	37.11 ± 2.29
Income (% ± SE)			
0%-130% poverty level	41.73 ± 3.28	29.93 ± 2.61	28.34 ± 3.86
131%-350% poverty level	33.99 ± 2.65	33.49 ± 1.91	32.52 ± 3.07
>350% poverty level	24.22 ± 1.98	32.35 ± 2.48	43.43 ± 2.61

MSA indicates metropolitan statistical area.
[a] The HEI is used to estimate overall quality of dietary intake.
[b] Variable selection guided by the Bergner [21] model of health status.

Table 3
Relationship of overall dietary quality and selected sociodemographic characteristics of US Adolescents: data from the CSFII

Sociodemographic characteristics[a]	OR	95% CI
Individual factors		
Age in years[b]	1.16	(1.10, 1.22)
Sex		
Female	–[c]	–
Male	1.12	(0.86, 1.45)
Ethnicity		
Hispanic	0.92	(0.62, 1.36)
Non-Hispanic White	–	–
Non-Hispanic Black	2.27	(1.43, 3.60)
Other	0.66	(0.27, 1.64)
Family factors (living arrangements)		
Region of residence		
Northeast	–	–
Midwest	1.27	(0.78, 2.09)
South	1.96	(1.23, 3.12)
West	1.45	(0.88, 2.37)
Urbanization		
MSA (central city)	–	–
MSA (outside city)	1.20	(0.83, 1.72)
Non-MSA (rural)	2.14	(1.38, 3.32)
Household members[b]	0.93	(0.83, 1.05)
Household head education		
Less than high school	1.67	(1.01, 2.76)
HS	1.56	(1.15, 2.11)
More than high school	–	–
Female head of household		
Yes	0.86	(0.58, 1.26)
No	–	–
Income		
0%-130% poverty level	0.99	(0.58, 1.72)
131%-350% poverty level	1.19	(0.86, 1.65)
>350% poverty level	–	–

[a] Variable selection guided by the Bergner Model of Health Status [21].
[b] Continuous variable.
[c] Reference group.

3. 1. Individual and family factors associated with HEI scores

Tables 2 and 3 depict the percentages of US adolescents in each HEI tertile by individual and family factors as described by Bergner's model and the relationships between overall dietary quality and selected sociodemographic (individual and family) characteristics of US adolescents. Individual sociodemographic factors that significantly related to overall dietary quality among US adolescents included age and ethnicity. Overall quality of dietary intake declined significantly as adolescents progressed in age (odds ratio [OR], 1.16; 95% confidence interval [CI], 1.10-1.22). Furthermore, non-Hispanic African American adolescents were 1.3 times as likely as non-Hispanic white adolescents to have less than desirable diets (OR, 2.27; 95% CI, 1.43- 3.60). Among the family sociodemographic factors tested, region of residence, urbanization, and education level of the household head were the only factors found to be significantly related to overall quality of dietary intake within the model. Adolescents from the southern United States were 96% more likely to have lower-quality diets than adolescents from the northeastern United States (OR, 1.96; 95% CI, 1.23-3.12). Rural adolescents were 1.1 times more likely than urban adolescents to have poor quality of dietary intake (OR, 2.14; 95% CI, 1.38-3.32). US adolescents who resided in households headed by individuals with a high school education were 56% more likely to have lower quality diets than adolescents who resided in households headed by individuals with more than a high school education (OR, 1.56; 95% CI, 1.15-2.11). This risk

increased to 67% for adolescents in households headed by individuals with less than a high school degree (OR, 1.67; 95% CI, 1.01-2.76).

4. Discussion

The purpose of this study was to assess the relationship between sociodemographic factors and the overall dietary quality of US adolescents. The current study found that the overall quality of dietary intake of US adolescents is poor when compared with national guidelines. The overall mean HEI score for adolescents was 61.9 of a possible score of 100. Healthy Eating Index scores of more than 80 suggest a "good" diet, whereas scores ranging between 51 and 79 indicate a diet that "needs improvement' [16]. Adolescents are less likely than any other age group to consume diets that comply with the Dietary Guidelines for Americans [14,15]. The typical adolescent diet is poor in overall quality, high in total fat, saturated fat, and sugar, and low in fruits, vegetables, and dairy products. Diets of poor quality in adolescence have been linked with several chronic diseases in later life [23-25].

The current study also found that the overall quality of dietary intake of US adolescents was significantly related with several individual and family factors. Overall, adolescents having the poorest dietary quality were older, non-Hispanic African Americans who resided in the rural south and whose household head had an education level of a high school degree or less. Results from the current study regarding the relationships between overall dietary quality and sociodemographic characteristics appear to be similar to the US population in general [14,15]. The apparent associations between quality of dietary intake and socio-demographic factors present a strong case for the application of ecological models, such as Bergner's [21] model of health status, in nutrition research and intervention.

Bergner's [21] model of health status, used for the selection of sociodemographic factors in the current study, represents a theoretical framework for understanding the connections between people and their environments [26]. The application of the ecological perspective to dietary behaviors is particularly germane because of the multifaceted nature of dietary influences [27]. In the current study, dietary influences were categorized into 2 groups, individual factors and family factors, because adolescents, to a large extent, remain dependent on family resources.

Individual factors are intrapersonal characteristics that may directly affect a person's behavior [28]. In the current study, individual factors found to be significantly related to overall dietary quality were age and ethnic background. Quality of dietary intake declined as adolescents progressed in age. This decline in dietary quality may be due, in part, to the fact that older adolescents are more autonomous than their younger counterparts and, therefore, make more of their own food choices [4,12]. In addition, it has been suggested that the more meals adolescents consumed at home, the better the dietary quality of their intakes [29,30]. Older adolescents consume fewer meals at home, which may explain their lower dietary quality compared with that of younger adolescents [29,30]. Ethnic background was also found to be significantly related to overall dietary quality of adolescents. US population studies [14,15] indicate that African American adolescents tend to have lower HEI component scores for milk, vegetable, and fat intakes than their non-Hispanic white peers. It is plausible that dietary patterns of African American adolescents may be influenced, in part, by cultural norms and traditional food behaviors [3 1].

Family factors include interpersonal and environmental issues [28] related to family that may impact an individual's behavior. In the current study, family factors that were significantly related to overall quality of dietary intake of US adolescents were region of residence, urban location, and education level of head of household. A larger percentage of adolescents residing in the southern US placed in the lowest group for HEI scores, indicating diets of poorer quality than adolescents residing in other regions in the United States. Previous studies have suggested similar results [10,14,32,33]. Johnson et al [10] suggested that urbanization is one of the most pertinent factors associated with quality of dietary intake.

In the current study, rural adolescents had poorer quality of dietary intake than urban and suburban adolescents as indicated by the largest percentage of rural adolescents placing in the lowest group for HEI scores. One possible explanation for the lower quality of dietary intake of rural adolescents may be related to the issue of food availability. Grocery stores in rural areas purportedly have less variety of foods, especially fruits and vegetables [2]. Lastly, adolescents' dietary behaviors are clearly affected by parental influence [6,7,34,35]. Parents provide food, model eating behaviors, and initiate early feeding practices [34]. Therefore, factors influencing parental dietary behavior would in turn affect the child's dietary behavior. One such factor is education attainment of the parent or head of household [36,37]. Purportedly, the higher the education level, the higher the income and wage potential and, consequentially, the greater the exposure to a wider variety of foods. Higher education levels are also thought to be related to increased awareness and practice of healthy behaviors [2]. In the current study, adolescents living in households headed by individuals who had the equivalent of a high school degree or less had significantly lower dietary quality than adolescents living in households headed by individuals with education levels above high school.

Conventional nutrition research has centered on investigating the relationships between single nutrients and disease risks [38]. In the current study, a total-diet approach was presented rather than a single-nutrient/single-food approach. Given the complexity of the human diet and the enormity of nutrient interactions in the human body, a total-diet research approach, such as the HEI, may be useful in linking overall dietary quality with chronic disease prevention. Healthy Eating Index scores have been linked to plasma carotenoids [38] and a variety of serum nutrient levels, particularly biomarkers of fruit and vegetable intake [39]. These studies confirm that the HEI is valuable in the study of overall dietary quality and chronic disease prevention. Therefore, the conclusion of this study that US adolescents have poor quality diets, based on HEI scores, should be a major public health concern.

One major strength of this study is the use of a nationally representative sample that allows generalization to US adolescents. In addition, the use of an averaged nonconsecutive 2-day food intake represents dependable dietary data. Although several factors were significant within the model tested, a potential limitation of the study is the lack of variables regarding attitudes, beliefs, and behaviors that would help clarify how adolescents make food selections as well as demonstrate overall environmental impact on adolescent diets as suggested in the conceptual model.

5. Conclusions

The current study demonstrated that the overall quality of dietary intake of US adolescents, as measured by the HEI, needs improvement and is significantly related to certain individual and family factors including age, ethnicity, urbanization, region of residence, and education level of household head. Given the associations between adolescent health status and adult health outcomes [23-25], new and innovative interventions are needed to improve the health behaviors, particularly dietary behaviors, of adolescents. It is suggested that more multidimensional total-diet studies be conducted to investigate the relationships between dietary quality and chronic disease prevention.

References

[1] Kochanek KD, Smith BL. Deaths: preliminary data for 2002 National vital statistics report, vol. 52, no. 13. Hyattsville (Md): National Center for Health Statistics; 2004.

[2] Frazeo E. The American diet: a costly problem. Food Rev 1996;19: 2-6.

[3] Patterson RD, Haines PS, Popkin BM. Health lifestyle patterns of U.S. adults. Am J Prev Med 1994;23:453 - 60.

[4] Crockett SJ, Sims LS. Environmental influences on children's eating. J Nutr Educ 1995;27:23 5 - 49.

[5] Keim KS, Stewart B, Voichick J. Vegetable and fruit intake and perceptions of selected young adults. J Nutr Educ 1997;29:80 - 5.

[6] Story M, Neumark-Sztainer D, Frenh S. Individual and environmental influences on adolescent eating behaviors. J Am Diet Assoc 2002; 1 02(Suppl 3): S40 - S5 1.
[7] Birch L, Fisher J. Development of eating behaviors among children and adolescents. Pediatrics 1998;101(Suppl):539-48.
[8] Harnack L, Walters SA, Jacobs Jr DR. Dietary intake and food sources of whole grains among US children and adolescents: data from the 1994-1996 Continuing Survey of Food Intakes by Individuals. J Am Diet Assoc 2003;103:1015-9.
[9] Neumark-Sztainer D, Story M, Resnick M, Blum R. Lessons learned about adolescent nutrition from the Minnesota Adolescent Health Survey. J Am Diet Assoc 1998;98:1449 - 56.
[10] Johnson R, Johnson D, Wang M, Smicklas-Wright H, Guthrie H. Characterizing nutrient intakes of adolescents by sociodemographic factors. J Adolesc Health 1994;15:149-54.
[11] Barr S. Associations of social and demographic variables with calcium intakes in high school students. J Am Diet Assoc 1994;94:260 - 6.
[12] Neumark-Sztainer D, Story M, Perry C, Casey M. Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. J Am Diet Assoc 1999;99:929-37.
[13] Basiotis PP, Kramer-LeBlanc CS, Kennedy ET. Maintaining nutrition security and diet quality: the role of the Food Stamp Program and WIC. Fam Econ Nutr Rev 1998;11:4 -16.
[14] Bowman SA, Lina M, Gerrior SA, Basiotis P. The health eating index, 1994-96. Fam Econ Nutr Rev 1998;11:2-14.
[15] Basiotis PP, Carlson A, Gerrior SA, Juan WY, Lino M. The Healthy Eating Index: 1999-2000. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. CNPP-12. 2002;3-5.
[16] Kennedy ET, Ohls J, Carlson S, Fleming K. The health eating index: design and applications. J Am Diet Assoc 1995;95:1103 - 8.
[17] U.S. Department of Agriculture. The food guide pyramid. Home and Garden Bulletin Number 252. Washington, DC: Center for Nutrition Policy and Promotion, U.S. Department of Agriculture; 1992.
[18] U.S. Department of Agriculture K, U.S. Department of Health and Human Services K. Nutrition and your health: dietary guidelines for Americans. Home and Garden Bulletin No. 232. 5th ed. Washington, DC: U.S. Department of Health and Human Services; 2000.
[19] U.S. Department of Agriculture, Agricultural Research Service. 1994-1996 Continuing Survey of Food Intakes by Individuals, 1998 [CD-ROM]. Washington, DC: U.S. Department of Agriculture; 2000.
[20] Standing Committee on Dietary Reference Intakes. Food and Nutrition Board—National Academy of Sciences; 1998.
[21] Bergner M. Measurement of health status. Med Care 1985;23: 696-704.
[22] Shuh BV, Burnwell BG, Biegler GS. SUDAAN user's manual, release 7.5 Research Triangle Park (NC): Research Triangle Institute; 1997.
[23] Freedman DS, Dietz WH, Srinivasan SR, Bereson GS. The relationship of overweight to cardiovascular risk factors among
children and adolescents: the Bogalusa Heart Study. Pediatrics 1999; 103:1175-82.
[24] Must A, Jacques PF, Dallal GE, Bajema CJ, Dietz WH. Long-term morbidity and mortality of overweight adolescents: a follow-up of the Harvard Growth Study of 1922 to 1935. N Engl J Med 1992;327: 1350-5.
[25] Pinhas-Hamiel O, Dolan LM, Daniels SR, Standiford D, Khoury PR, Zeitler P. Increased incidence of non–insulin-dependent diabetes mellitus among adolescents. J Pediatr 1996;128:608-15.
[26] Stokols D. Establishing and maintaining healthy environments: toward a social ecology of health promotion. Am Psychol 1992;47: 6-22.
[27] Sallis JF, Owen N. Ecological models. In: Glanz K, Lewis FM, Rimer BK, editors. Health behavior and health education: theory, research and practice. San Francisco: Jossey-Bass; 1996. p. 403 - 24.
[28] Bronfenbrenner U. The ecology of human development. Cambridge (Mass): Harvard University Press; 1979.

[29] Gillman MW, Rifas-Shiman SL, Frazier AL, Rockett HRH, Camargo CA, Field AE, et al. Family dinner and diet quality among older children and adolescents. Arch Fam Med 2000;9:235 - 40.
[30] Neumark-Sztainer D, Story M, Hannan PB, Croll J. Overweight status and eating patterns among adolescents: where do youths stand in comparison with the Healthy People 2010 Objectives. Am J Public Health 2002;92:844-51.
[31] Airhihenbuwa CO, Kumanyika S, Agurs TD, Lowe A, Saunders D, Morssink CB. Cultural aspects of African American eating patterns. Ethn Health 1996;1:245-60.
[32] Champagne CM, Bogle ML, McGee BB, Yadrick K, Allen HR, Kramer TR, et al. Lower Mississippi Delta nutrition intervention research initiative. J Am Diet Assoc 2004; 104:199 - 207.
[33] Brady LM, Lindquist CH, Herd SL, Goran MI. Comparison of children's dietary intake patterns with US dietary guidelines. Br J Nutr 2000;84:361-7.
[34] Fisher JO, Birch LL. Parents' restrictive feeding practices are associated with young girls' negative self-evaluation about eating. J Am Diet Assoc 2000;100:1341-6.
[35] Birch LL. Childhood overweight: family environmental factors. In: Chen C, Dietz WH, editors. Obesity in childhood and adolescence. Philadelphia: Vevey/Lippincott Williams and Wilkins; 2002. p. 161-76.
[36] Frazao E. Female-headed households spend less on food. Food Rev 1996;6 - 11.
[37] Crawford PB, Obarzanek E, Schreiber GM, Barrier P, Goldman S, Frederick MM, et al. The effect of race, household income, and parental education on nutrient intakes of 9- and 10-year-old girls. AEP 1995;5:360-8.
[38] Hann CS, Rock CL, King I, Drewnowski A. Validation of the Healthy Eating Index with use of plasma biomarkers in a clinical sample of women. Am J Clin Nutr 2001;74:479 - 86.
[39] Weinstein SJ, Vogt TM, Gerrior SA. Healthy Eating Index scores are associated with blood nutrient concentrations in the third National Health and Nutrition Examination Survey. J Am Diet Assoc 2004;104(4):576-84.